Geophysical Research Abstracts
Vol. 13, EGU2011-11070-1, 2011
EGU General Assembly 2011


# Separation of induced and remanent anomalies through analyses of multiple aeromagnetic surveys

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Repeated high-quality aeromagnetic surveys have the intriguing potential to separate the purely induced component from the purely remanent component of the magnetic anomalies. This is possible in cases where the geomagnetic field has substantially changed between the two surveys $A$ and $B$ due to secular variation. By upward continuation of both surveys to a common grid, the anomaly $F$ of the two data sets consists of a remanent part $R$ and an induced part $\chi H_{A,B}$

$$F_A = |R + \chi H_A|, \;\; F_B = |R + \chi H_B|,$$

the difference $F_B - F_A$ mainly results from the magnetization induced by the secular variation $\Delta H = |H_B - H_A|$. In many places of the world the secular variation during the last 20 years has been more than 500 nT, giving a sufficiently high signal-to-noise ratio in the difference of two high-quality aeromagnetic surveys. In this case it is possible to map the approximation of $\chi$ given by

$$F_B - F_A / \Delta H.$$

Moreover, one can obtain estimates of $R$ by combining $\chi$ with the IGRF values of $H_{A,B}$. This makes it possible to identify positive remanent magnetic anomalies in crustal rocks, a topic of high relevance with respect to mineral exploration and lamellar magnetism. The method is tested using case studies on high-latitude aeromagnetic surveys from Norway and the Norwegian shelf, which were acquired in the same geographic area with a minimum time difference of 15 years. An analogous technique may be applicable to analyze the crustal field using repeat measurements from low-orbit CHAMP and the forthcoming SWARM satellite missions.